ERA HELICOPTERS, INC.
GULF COAST DIVISION
LAKE CHARLES, LOUISIANA

PROCESS SPECIFICATION

PROCESS SPECIFICATION NUMBER: ERA-2002

FABRICATION OF NON-STRUCTURAL EXTERIOR COMPONENTS

PREPARED BY: John E. Stanley DATE: 3/9/87
John E. Stanley
MESH PLASTICS LTD.

APPROVALS

MANUFACTURING	QUALITY CONTROL	ENGINEERING	
Donald W. Dickens	John E. Stanley	[illegible]	MESH
L F Lamm	David K. Murphy	[illegible]	ERA

ERA HELICOPTERS, INC.
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PROCESS SPECIFICATION

Scope: This specification outlines the requirements for fabricating non-structural exterior components.

Conformation: This specification does not conform to any existing government specification.

Subcontractors: MESH PLASTICS, LTD. of Lake Charles, Louisiana, or its subcontractor shall be the only subcontractors qualified to construct the FRP requirements and shall comply with this process specification. Any deviations or variations are to be submitted to ERA for approval with proper documentation prior to fabrication.

Conflicts: In the event of a conflict with engineering drawing(s) and this specification, the drawing(s) shall govern.

Fabrication of Non-Structural Exterior Components

Rev	Date	Pages	Approvals					
			Manufacturing		Quality Control		Engineering	
			MESH	ERA	MESH	ERA	MESH	ERA
IR	3/9/87	ALL						

MATERIALS

MATERIAL	NAME	MANUFACTURER
Resin	Derakane 8084	Dow Chemical Midland, MI
Promoter	Cobalt Napthenate	AKZO Chemie New Brunswick, NJ
Accelerator	Dimethylaniline	Buffalo Colors West Paterson, NJ
MEKP Catalyst	Hi Point 90	Witco Chemical Richmond, CA
	Lupersol DHD 9	Lucidol Chemical Buffalo, NY
Mold Release	PVA	Rexco Carpenteria, CA
	Cerea Mold Release Wax	Ceara Products,Inc. Denver, CO
UV Inhibitor	UV-9	Industrial Chemicals Atlanta, GA
Pigment	CoPlas	CoPlas Fort Smith, AR
	Spartan	Spartan Pigments Houston, Tex.
Gel Coat	Gel Coat	CoPlas Inc. Ft. Smith, Ark.

DATE	ENGINEERING ORDER	E.O. No.	SHT.
6/26/95		A-1	1 OF 1
BY: T. Harville	TITLE: PROCESS SPECIFICATION	DWG. AFFECTED: 2002	
APPROVED BY: T. Schuck		ENTERED ON COMPUTER BY: DATE:	

REASON FOR CHANGE: ADD ALT P/N FOR 3/4 & 1 1/2 oz TYPE "E" GLASS MAT (M127)

3/4 oz TYPE "E" GLASS MAT.	M113-3/4 oz	CERTAINTEED WICHITA FALLS, TX.
	OR	
	M127-3/4 oz	CERTAINTEED WICHITA FALLS, TX.
1 1/2 oz TYPE "E" GLASS MAT.	M113-1 1/2 oz	CERTAINTEED WICHITA FALLS, TX.
	OR	
	M127-1 1/2 oz	CERTAINTEED WICHITA FALLS, TX.

MATERIALS

MATERIAL	NAME	MANUFACTURER
3/4 oz Type 'E' glass mat	M113 - 3/4 oz.	Certainteed Wichita Falls, TX
Kevlar Woven Roving	K 49/051	Knytex Seguin, TX
	285- F100	Hexcel Chicago, IL
Paraffinated Styrene	TF-100	Industrial Chemicals Atlanta, GA
Grinding Discs	36 Grit Type D 60 Grit Type C 80 Grit Type C	3M Corp. St. Paul, MN

Kevlar is a registered Trademark of E.I. Dupont & de Nemours & Co.

Laminate Manufacture

1) Inspect mold for defects (ie. chips, cracks, crazing, etc. ...). DO Not proceed until any defect is corrected.

2) Apply mold release agent(s) according to manufacturer's instructions.

3) Apply gel-coat containing UV inhibitor onto mold using a spray gun for a nominal thickness of 10 mils.

4) Allow gel-coat to cure for 4 - 6 hours and become tack free.

5) Apply one layer of 3/4 oz. chopped strand mat on mold surfaces. Saturate with Derakane 8084 resin containing UV inhibitor and pigment. Deaerate with serrated rollers.

6) Apply one layer of Kevlar woven roving over entire mold surface. Saturate with Derakane 8084 resin containing UV inhibitor and pigment. Deaerate with serrated rollers and plastic squeegees.

7) Apply second layer of 3/4 oz. chopped strand mat over entire mold surface. Saturate with Derakane 8084 resin containing UV inhibitor and pigment. Deaerate with serrated rollers.

8) Allow resin to gel before continuing.

9) Separate FRP item from mold and trim.

Edge Sealing: Cut edges will receive a coating of paraffinated Derakane 8084 resin.

INSPECTION

It is the purpose of the inspection to verify that each part has been fabricated in accordance with and meets the requirements of this specification.

RESPONSIBILITIES: It is the responsibility of the fabricator to make available to ERA Helicopter or his authorized representative any or all of the following:

Records: Records pertaining to the fabricated part being purchased shall be supplied when requested. These may include:

- Materials specifications
- Part drawings or mold jig
- Materials test results.
- Dimensional verification reports.
- Rework and repair reports.

MATERIALS:

Raw materials used for laminates shall be virgin materials and shall be free of contaminants as described on pgs. 9, 10, 11, and 12.

FABRICATED PARTS: The parts to be inspected shall be properly located and positioned, and shall be in condition to permit safe and thorough inspection. Reasonable means shall be provided to permit the inspector to visually examine the entire inner and outer surfaces of the part.

Allowable defects are listed on pgs. 7 and 8.

The following inspection tools and equipment shall be made available for use by the inspector.

- Barcol hardness tester.
- Acetone squeeze bottle with acetone.
- Extension cord with ground fault switch.
- A vapor tight inspection light.
- Thickness gauge.

INSPECTION

TEST OF FINISHED EQUIPMENT:

The following basic tests shall be included as a minimum in the Acceptance Inspection.

Barcol Hardness Test - A test of resin cure shall be made in accordance with ASTM D2583. Take 10 readings, discard highest and lowest reading and average the remaining. The mimimum acceptable average reading is 30.

Surface Cure Test - An acetone test shall be used to detect surface inhibition on surfaces exposed to air during cure. The procedure that shall be used is the following: rub a few drops of acetone on the surface and check for tackiness after the acetone has evaporated. Persistent tackiness indicates incomplete cure.

Dimensions - The inspector shall be provided with copies of all approved drawings or mold jigs.

APPLICABLE DOCUMENTS:

ASTM Standards

C 581-74-Test Method for Chemical Resistance of Thermosetting Resins Used in Glass Fiber Reinforced Structures.

D 638-77a-Test method for Tensile Properties of Plastics.

D 790-71-Test Methods for Flexural Properties of Plastics and Electrical Insulating Materials.

D 883-78a-Definitions of Terms Relating to Plastics.

D 2583-75-Test Method for Identation Hardness of Rigid Plastics by Means of a Barcol Impressor.

ALLOWABLE DEFECTS

Defect	Surface inspected: Mold Side	Surface inspected: Non-finished Side
Cracks	None	None
Crazing (fine surface cracks)	None	Max dimension 1/2 in., max density 5 per sq. ft. min 2 in. apart
Blisters(rounded elevations of the laminate surface over bubbles)	None	Max 1/4 in., dia x 1/8 in. high, max 1 per sq ft, min 2 in. apart
Wrinkles and solid blisters	Max deviation, 20% of wall thickness, but not exceeding 1/8 in.	Max deviation, 20% of wall thickness but not exceeding 1/8 in.
Pits(craters in the laminate surface)	Max dimensions, 1/8 in. dia x 1/32 in. deep. Max number,10 per sq ft	Max dimensions, 1/8 in dia x 1/16 in deep, max density 10 per sq. ft.
Surface porosity(pin-holes or pores in the laminate)	None	Max dimensions, 1/16 in dia x 1/16 in deep, max density 10 per sq. ft.
Chips	None	Max dimension of break, 1/4 in, and thickness no greater than 20 percent of wall thickness, max density 1 per sq ft
Dry spot(nonwetted reinforcing)	None	Max dimension, 2 sq in. per sq ft
Entrapped air (bubbles or voids in the laminate)	1/16 in max dia., 10 per sq in. max density, but none within 1/32" of the surface	1/8 in. max dia, 4 per sq in. max density; 1/16 in. max dia. 10 per sq in. max density

ALLOWABLE DEFECTS

Defect	Surface inspected: Mold Side	Surface inspected: Non-finished Side
Exposed Glass	None	Okay. Sand to remove sharp edges.
Burned Areas	None	None
Exposure of cut edges	None	Okay. Sand smooth.
Scratches	None	Okay. Sand smooth.
Foreign Matter	None	1/16 in dia, max density 1 per sq. ft.

FIBERGLASS CHOPPED STRAND MAT

1.0 Scope

1.1 The scope of these procedures is to describe the visual, physical and mechanical parameters which characterize fiberglass chopped strand mat used by the fabricator.

2.0 Definitions

2.1 Chopped Strand Mat - Chopped strand mat is made from randomly oriented glass strands which are held together in mat form using a binder. Each strand contains a sizing.

3.0 Requirements

3.1 Visual Requirements - Each roll of chopped strand mat shall be inspected to insure it is consistent in color, texture and appearance. It shall be free from surface irregularities, fluffy masses, dirt spots or other foreign material; water spots, knots, binder spots larger than 2" in diameter, clumps of strands and tears of holes which may result form removal of defects.

3.2 Physical Requirements

3.2.1 Weight - The square foot weight of the mat shall be measured for each carton of mat used. All specimens shall fall within the range specified for the product.

3.3 Packaging Requirement - Packaging shall be visually inspected to assure proper labeling and that the package is free from damage that may render the mat unusable.

3.3.1 The mat shall be packaged in an unbroken carton as shipped from the mat manufacturer's factory. The mat used shall not be repackaged in the distribution of the mat after the manufacturer has shipped the mat.

FIBERGLASS CHOPPED STRAND MAT

3.4 Documentation - It is the responsibility of the fabricator to maintain records showing the results of all material testing. This information shall show at a minimum, the following:

(a) Form of material
(b) Manufacturer
(c) Manufacturer's product description including binder type (treatment)
(d) Manufacturer's product code
(e) Production date, if available, or production code on carton.
(f) Property measured and value recorded

* Visual inspection
* Width
* Thickness
* Packaging

(g) Job number (Internal Fabricator Control Number)

(h) Fabricated part identification number

KEVLAR WOVEN ROVING

1.0 Scope

1.1 The scope of these procedures is to describe the visual, physical and mechanical parameters which characterize kevlar woven roving used by the fabricator.

2.0 Definitions

2.1 Kevlar Woven Roving - Kevlar fiber rovings woven into a heavy weight fabric.

2.2 Wrap Ends - The rovings which run in the longitudinal direction of the fabric, i.e., along the roll length of the fabric.

2.3 Fill Picks - The rovings which run in the transverse direction of the fabric, i.e., across the roll length of the fabric.

2.4 Leno Strands - A pair of warp ends at each edge of the woven fabric. One Leno warp end is always over each fill pick while the other Leno warp end is always under the fill pick. The Leno strands define the edges of the woven field and serve to stabilize the edges of the fabric.

3.0 Requirements

3.1 Visual Requirements

3.1.1 Dirt Spots - Defined as all foreign matter, dirt, grease spots, etc. - The average number of dirt spots (1/16" to 3/4" in diameter) per 100 lineal feet shall be 6 or less. All rolls shall be free of dirt spots in excess of 3/4" diameter.

3.1.2 Warp Ends - All rolls shall be free of missing warp ends for more than two consecutive feet.

3.1.3 Fill Picks - All rolls shall be free of consecutive missing picks in excess of five, or more than eleven missing picks, either individual picks or any combination of individual and multiple (2, 3, 4, or 5) picks, in any consecutive 100 lineal feet.

3.1.4 Fuzz Clumps and Loops - The product is designed to exhibit proper laydown and shall be free of fuzz clumps or loops exceeding one inch in height from the surface.

KEVLAR WOVEN ROVING

3.2 Physical Properties

3.2.1 Thickness - The thickness of the mat in each roll of kevlar woven roving shall be measured.

3.3 Packaging Requirement - Packaging shall be visually inspected to assure proper labeling and that the package is free from damage that may render the kevlar woven roving unusable.
3.3.1 The kevlar woven roving shall be packaged in an unbroken carton as shipped from the manufacturer's factory. The kevlar woven roving used shall not be repackaged in the distribution of the kevlar woven roving after the manufacturer has shipped the kevlar woven roving.

3.4 Documentation - It is the responsibility of the fabricator to maintain records showing the results of all material testing. This information shall show at a minimum, the following:

(a) Form of material
(b) Manufacturer
(c) Manufacturer's product description including binder type (treatment)
(d) Manufacturer's product code
(e) Production date, if available, or production code on carton.
(f) Property measured and value recorded

* Visual inspection
* Width
* Thickness
* Packaging

(g) Job number (Internal Fabricator Control Number)

(h) Fabricated part identification number

U.S. Department
of Transportation
**Federal Aviation
Administration**

MANUFACTURING INSPECTION DISTRICT OFFICE #43
SUITE 102A, 11503 JONES MALTSBERGER ROAD
SAN ANTONIO, TEXAS 78216

June 30, 1987

Mr. David K. Murphy
Chief Inspector
ERA Helicopters, Inc.
P.O. Box 6566
Lake Charles, Louisiana 70606

Dear Sir:

The following ERA Helicopters process specifications with associated FAA Form 8110-3 have been reviewed for quality control provisions and found acceptable:

ERA 1000 IR dated May 14, 1987
ERA 1000 "A" dated June 12, 1987
ERA 1016 IR dated April 17, 1987
ERA 1018 "A" dated May 11, 1987
ERA 1019 IR dated May 4, 1987
ERA 1020 IR dated June 12, 1987
ERA 1021 IR dated June 12, 1987
ERA 2002 IR dated March 9, 1987
ERA 4004 IR dated May 4, 1987
ERA 4006 IR dated April 17, 1987

The process specifications with associated FAA Form 8110-3 have been forward to FAA Engineering for post review.

Sincerely,

John F. Selgrath

John F. Selgrath
Acting Manager